Reporting rates of bird species in remnant woodland vegetation plateau three years after a drought breaks

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There is evidence of widespread historic declines of woodland-dependent species in southern Australia, including many bird species as reviewed by Ford (2011), although there is a need for well-designed studies to determine the current population trends (Rayner *et al.* 2014). The loss and fragmentation of native woodlands that has accompanied agricultural development (Yates and Hobbs 1997, Bedward *et al.* 2007) have been linked to these declines (Ford 2011). However, drought is likely to have further suppressed many woodland animal populations during the period 2001 to 2010, with declines of bird species in south-west Western Australia (Recher and Davis 2014), Victoria (Mac Nally *et al.* 2009, Bennett *et al.* 2014) and the central-western New South Wales (NSW) wheatbelt (Ellis and Taylor 2013).

Our larger study aimed to document changes over time to the avifauna in woodland in the Macquarie-Bogan sub-region of central NSW and to investigate relationships with landscape and climatic conditions (Ellis and Taylor 2014). By December 2012, flooding rainfall events of 2010 returned some vigour to woodland avifauna in small remnants in central-western NSW, as evidenced by increased recording rates during our surveys, but the remnants contained a similar diversity of species to during the drought years 2005-2009 (Ellis and Taylor 2014). However, historical records indicate a higher potential avifaunal diversity for this area (Blakers *et al.* 1984). If flooding rains have lasting, long-term effects on the avifauna then, as remnants are colonised from drought refugia, there needed be a continued increase in the diversity of birds in the woodlands beyond that observed in 2012 by Ellis and Taylor (2014).

Consequently, we repeated the 2012 bird sampling in the last quarter of 2013 and January 2014 (hereafter referred to as the 2013 survey period) to determine if the increase in reporting rates across the post-flood years continued, and if additional species were colonising the remnants.

The study area in the vicinity of Narromine and the 10-minute bird census methods on our 1-ha sites are described in Ellis and Taylor (2013). Rainfall history is described in Ellis and Taylor (2014). Rainfall for 2013 was not recorded for all months at Narromine, but annual rainfall for Narromine over 121 years up to 2012 ranged from 217 to 1386 mm with a mean of 527 mm (Source: Bureau of Meteorology station 51037). The adjacent towns of Trangie (station 051049) and Dubbo (station 065070) recorded 335.6 and 493.0 mm respectively in 2013 (below the median value for those two locations) indicating that at the time of the 2013 surveys, the region was drier than for the previous two years. After a lull for the two years following the floods, there was widespread use of stock routes and road reserves for moving and feeding sheep and cattle during the 2013 survey period indicating a decline in pasture availability due to the lower rainfall (Figs 1 and 2). Productivity within the remnant native vegetation was also likely to have suffered a corresponding decline as ground cover vegetation dries (Figs 3-6).

During 426 surveys in the 2013 survey period we collected 2975 bird records of a total of 102 species, including eight waterbird species, down from the 130 species recorded during the 2119 surveys conducted post-drought from 2010 to12 (Ellis and Taylor 2014). Thirty-nine species had reporting rates of less than 1%, while 27 had rates above 10%. The 15 most frequently reported species were: Noisy Miner *Manorina melanocephala* (62%), Galah *Eolophus roseicapilla* (54%), Australian Magpie *Cracticus tibicen* (41%), Grey-crowned Babbler *Pomatostomus temporalis* (28%), Crested Pigeon *Ocyphaps lophotes* (25%), Apostlebird *Struthidea cinerea* (24%), Magpie-lark *Grallina cyanoleuca* (24%), Pied Butcherbird *Cracticus nigrogularis* (22%), Eastern Rosella *Platycercus eximius* (19%), Rufous Whistler *Pachycephala rufiventris* (17%), Western Gerygone *Gerygone fusca* (17%), White-plumed Honeyeater *Lichenostomus penicillatus* (15%), Grey Butcherbird *Cracticus torquatus* (15%), Willie Wagtail *Rhipidura leucophrys* (14%), and Laughing Kookaburra *Dacelo novaeguineae* (13%). This is similar to the post-drought list in Ellis and Taylor (2014) except that the Rufous Whistler and White-plumed Honeyeater displaced the Striated Pardalote *Pardalotus striatus* and Blue Bonnet *Northiella haematogaster*.

In the 2013 survey period, the number of bird species found around each site, combining the results of the replicate counts, varied from 8 to 34 with a median of 19 (mean ± SD = 19.1 ± 6.6). The median number of species recorded for each 10-minute survey fell to 6.5, while the upper quartile remained at 9, but the maximum

Table 1. The number of surveys (n) and of the number of species recorded per survey for each of the eight survey periods including the seven reported in Ellis and Taylor 2014.

		Number of species per survey				
Period (year)	n	Minimum	Lower Quartile	Median	Upper Quartile	Maximum
2005/06	335	1	5	7	10	21
2006/07	1012	0	5	6	9	24
2007/08	853	1	5	7	9	18
2008/09	699	1	5	6	8	22
2010/11	855	1	4	6	8	21
2011/12	838	1	5	6	9	20
2012/13	426	1	5	7	9	17
2013/14	426	1	5	6.5	9	20

rose to 20, similar to the number immediately post-drought (Table 1). Had the post-flooding increases found in 2011 and 2012 (Ellis and Taylor 2014; Fig. 7) continued, then we could have expected the mean to have reached around 7.6 species per 10-minute survey. However, the mean declined slightly from 2012 (7.2 ± 0.2 SE) to 2013 (7.0 ± 0.2 SE) across the 426 surveys (Fig. 7).

Bird population response to the flooding rains of 2010 in terms of species detected per 10-minute survey appears to have peaked by the end of 2012 (Table 1; Fig. 7). This contrasts with wetland birds which had peak populations in eastern Australia in 2010 and then declined markedly for the following three years (Porter and Kingsford 2013). No dramatic increases in species richness in the remnant woodlands were detected, indicating that widespread recolonisation of patches had not occurred, apart from the short-lived abundance of quails immediately post-drought (Ellis and Taylor 2014). This pattern is reflected in Victorian woodlands (Bennett *et al*. 2014) where there were increases for a limited subset of species, but no general increase in bird populations when the drought broke. Three possible explanations for that limited response in

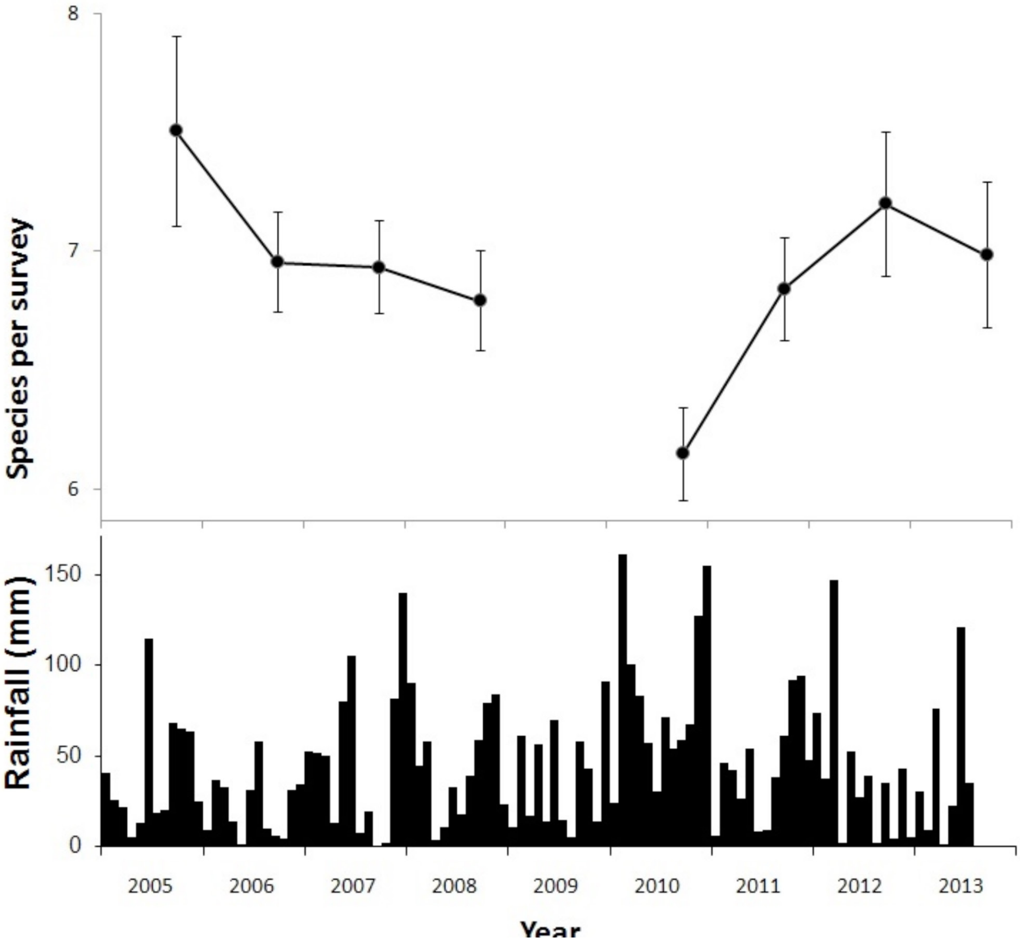

Figure 7. Mean number of bird species detected per survey (± 95% confidence limits) showing a decline across the drought period followed by a rise and plateau after the 2010 floods. The lower graph shows the recorded monthly rainfall at Narromine.

south-eastern Australia could be (i) that bird populations had not increased enough to warrant emigration from their natal patches, (ii) the unoccupied remnants were not accessible across the agricultural landscape, or (iii) the patches had not developed the necessary features post-drought to attract colonisation. Whereas the Victorian surveys were conducted until 2012, meaning that Bennett *et al*. (2014) speculated that there may be on-going population recovery, our data indicate that this hope is unlikely to be fulfilled.

Whichever explanation proves to be the driver of this limited population rebound post-drought, these results support Recher and Davis (2014) that average conditions in remnant temperate woodlands do not support growth in woodland bird populations. The conclusions of Mac Nally *et al.* (2009) and Bennett *et al*. (2014) that there is depressed vigour in woodland avifauna because of reduced productivity of the native vegetation due to degradation and fragmentation, and to the impacts of increasing temperatures seem to apply to the woodlands in central NSW. Restoration of these woodland bird communities cannot be achieved by waiting for high rainfall years but, as recommended by Recher and Davis (2014), requires active habitat reconstruction and management across the range of scales from patch productivity to continental connectivity.

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References

Bedward, M., Simpson, C. C., Ellis, M.V. and Metcalfe, L.M. 2007. Patterns and determinants of historical woodland clearing in central-western New South Wales, Australia. *Geographical Research* **45**: 348-357. DOI: 10.1111/j.1745-5871.2007.00474.x

Bennett, J.M., Nimmo, D.G., Clarke, R.H., Thomson, J.R., Cheers, G., Horrocks, G.F, Hall, M., Radford, J.Q., Bennett, A.F. and Mac Nally, R. 2014. Resistance and resilience: can the abrupt end of extreme drought reverse avifaunal collapse? *Diversity and Distributions*. DOI: 10.1111/ddi.12230

Blakers, M., Davies, S.J.J.F. and Reilly, P.N. 1984. *The Atlas of Australian birds*. Melbourne University Press, Melbourne.

Ellis, M.V and Taylor, J.E. 2013. Birds in remnant woodland vegetation in the central wheatbelt of New South Wales during the drought declared years 2005 to 2009. *Australian Zoologist* **36**: 332-348. DOI: 10.7882/AZ.2012.019

Ellis, M.V and Taylor, J.E. 2014. After the 2010 rains: changes in reporting rates of birds in remnant woodland vegetation in the central wheatbelt of New South Wales, Australia, from drought to post-drought. *Australian Zoologist* **37**: 29-39. DOI: 10.7882/AZ.2014.007

Ford, H.A. 2011. The causes of decline of birds of eucalypt woodlands: advances in our knowledge over the last 10 years. *Emu* **111**: 1–9. DOI: 10.1071/MU09115

Mac Nally, R., Bennett, A.F., Thomson, J.R., Radford, J.Q., Unmack, G., Horrocks, G. and Vesk, P.A. 2009. Collapse of an avifauna: climate change appears to exacerbate habitat loss and degradation. *Diversity and Distributions* **15**: 720-730. DOI: 10.1111/j.1472-4642.2009.00578.x

Porter, J.L. and Kingsford, R.T. 2013. Summary of annual Aerial Survey of Wetland Birds in Eastern Australia - October 2013. School of Biological, Earth and Environmental Sciences, University of New South Wales Report pp.29.

Rayner, L., Lindenmayer, D.B., Gibbons, P., and Manning, A.D. 2014. Evaluating empirical evidence for decline in temperate woodland birds: a nationally threatened assemblage of species. *Biological Conservation* **171**: 145-155. DOI: 10.1016/j.biocon.2014.01.029

Recher, H.F. and Davis, W.E., Jr. in press. Response of birds to episodic summer rainfall in the Great Western Woodlands, Western Australia. *Australian Zoologist* DOI: 10.7882/AZ.2014.011

Yates, C.J. and Hobbs, R.J. 1997. Temperate eucalypt woodlands: a review of their status, processes threatening their persistence and techniques for restoration. *Australian Journal of Botany* **45**: 949-973. DOI: 10.1071/BT96091

APPENDIX 1

Figure 1. Cattle that were being moved along a stock route drinking at a dam, with remnant woodland in the background. (J.E. Taylor December 2013)

APPENDIX I

Figure 2. Roadside *Eucalyptus* woodlands with the tracks of recent stock movements, a shrubby understorey with green foliage and the dry groundcover grasses. (J.E. Taylor December 2013)

Figure 3. The grazed banks of the Bogan River within a linear strip of river red gum forest with a recently dead river red gum *Eucalyptus camaldulensis* and a drying waterhole. (December 2013)

Figure 4. Myall *Acacia pendula* woodland with young recruits with dense foliage among the adult trees and a ground cover of standing dead grass and chenopods. (J.E. Taylor December 2013)

APPENDIX I

Figure 5. *Eucalyptus* woodland with healthy shrubs in the understorey but with few grasses remaining in the ground layer which is accumulating *Eucalyptus* leaf litter. (J.E. Taylor December 2013)

Figure 6. A *Eucalyptus* woodland with regenerating tree canopies showing evidence of past tree removal in the form of ring-barked and cut stumps. (J.E. Taylor December 2013)